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FAO Plant Protection Bulletin

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World Reporting Service on Plant Diseases and Pests

A Survey of Virus Diseases of Grasses in Northern Europe[1]

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During the summer of 1956,[2] five virus diseases were observed on cereal and forage grasses in England. Only cocksfoot mosaic (16) and barley yellow dwarf (18) were previously known in England. Barley stripe mosaic (often called barley false stripe), which in North America was known to be caused by a virus (8), had not been recognized in England. Ryegrass mosaic and European cereal striate mosaic had been observed but not recognized as virus diseases.

During April and May 1957, a survey was made for virus diseases on cereals and other grasses in western and northern Europe. Arrangements were made with scientists at various research institutions to search for virus diseases in experimental plots and in fields in the neighboring countryside.

This report includes brief descriptions of each of the diseases, notes on where they were observed, and discussions on their probable significance in Europe. Table 1 indicates the countries in which the diseases were observed.

The following scientists assisted in arrangements for the survey:

Dr. Jacques Ponchet, Station centrale de pathologie végétale, Versailles, France.

Ir. J.P.H. van der Want, Instituut voor Plantenziektenkundig Onderzoek, Wageningen, the Netherlands.

Dr. O. Bode, Biologische Bundesanstalt für Landwirtschaftliche Virusforschung, Braunschweig, Germany.

Prof. Dr. M. Klinkowski, Biologische Zentralanstalt, Institut für Phytopathologie Aschersleben, Aschersleben, Germany.

Dr. H. Rønde Kristensen, Statens Plantepatologiske Forsøg, Lyngby, Denmark.

Dr. Fajer Fajersson, Plant Breeding Institution Weibullsholm, Landskrona, Sweden.

Dr. D. Lihnell, Statens Vaxtskyddsanstalt, Stockholm, Sweden.

Prof. K. Björling, Kungl. Lantbrukshögskolan, Institutionen för Växtsjukdomslära, Uppsala, Sweden.

Dr. Onni Pohjakallio, Institutum Phytopathologicum, Universitatis Helsinkiensis, Malmi, Viik, Finland.

Mr. Erling Strand, Norges Landbrukshøgskole, Vollebekk, Norway.

The author also enjoyed the generous assistance of many other people associated with the above-mentioned and other research institutions and experimental stations visited during the survey. The success and enjoyment of the trip was greatly increased by the presence of Mr. R. S. Badami, Rothamsted Experimental Station, Harpenden, England, and Dr. C. Martini, Institut für Pflanzenkrankheiten, Bonn, Germany, the former accompanying the author during the entire survey and the latter through the Netherlands and Germany.

An excellent review (7) of the occurrence and distribution of grass viruses in Europe

[1] Contribution No. 1665 from the Botany and Plant Pathology Division, Science Service, Canada Department of Agriculture, Ottawa, Ontario.

[2] When the author worked at Rothamsted Experimental Station on transfer from the Canada Department of Agriculture.

TABLE 1. *Occurrence of virus diseases on cereals and grasses in western and northern Europe.*

Country	Cocksfoot streak mosaic	Barley yellow dwarf	Ryegrass streak mosaic	Barley stripe mosaic	European cereal striate mosaic
England	++[a]	++	++	++	++
France	+	+	+	++	—
Netherlands . . .	+	++	++	—	—
Germany	+	+	+	++	+
Denmark	+	—	+	—	+
Sweden	+	+	+	—	?
Finland	—	++	++	—	?
Norway	—	++	—	—	—

[a] The following symbols are used to indicate the presence or absence of the disease:
++ Disease observed and proved by transmission tests. + Symptoms characteristic of the disease observed but no transmission tests performed. ? Presence of the disease indicated by the symptoms described by other observers and by the presence of the vector. — Disease not observed.

has recently been published, in which reference was made to some of the findings of the survey reported here, as well as to several viruses not encountered by the author during his survey.

Cocksfoot Streak Mosaic

Cocksfoot streak mosaic virus causes a light green to yellow streaking and sometimes a mottling of the leaves of *Dactylis glomerata*. It does not cause severe stunting of the plant or seriously affect seed production of *D. glomerata*, and no other plants have been found susceptible. The virus is sap-transmissible and has been transmitted by the aphids *Myzus persicae* Sulz and *Macrosiphum euphorbiae* Thomas. In 1952 it was found in several districts in the British Isles, notably near Leeds and Cambridge (16). A similar disease occurs in the United States (10).

During 1956 and 1957 cocksfoot streak mosaic was found in almost every district surveyed in England, Scotland and Wales, where *Dactylis glomerata* was commonly grown. It was also found in France, the Netherlands, Germany, Denmark and Sweden in most of the areas surveyed for the disease and where *D. glomerata* was common. Usually the diseased plants were scattered. One exception was at Hoofddorp, the Netherlands, where nearly all plants were diseased in a plot of ten-year-old clones. In contrast, the disease was not found on *D. glomerata* over a large area from Aschersleben to Petkus, Germany. The disease was not found in Finland or Norway, where the host is rare except in experimental plots.

Apparently cocksfoot streak mosaic is common in northwestern Europe. This disease probably causes some reduction in the productivity of older stands of *Dactylis glomerata* but it spreads too slowly and has too little effect on its only known host to be considered an economically important disease.

Barley Yellow Dwarf

Barley yellow dwarf is caused by an aphid-transmitted virus (11). Its vectors include *Macrosiphum granarium* (Kirby), *M. dirhodum* (Walker), *Rhopalosiphum maidis* (Fitch.), *R. prunifoliae* (Fitch.), *R. padi* (L.) and *Toxoptera graminum* Rond. The virus has not been transmitted mechanically nor is it carried in seed or soil. Leaves of diseased barley become a golden yellow color, the

change taking place from the tips downward. The plants may be severely stunted depending on the variety, the stage of development when infected, and the strain of virus. Leaves of infected plants usually stand more erect than normal. Symptoms on wheat and oats are generally similar to those on barley but the leaves of oats turn red rather than yellow as in barley and wheat. Sometimes the leaves of infected wheat at first turn a darker green than normal but yellowing usually occurs later. The barley yellow dwarf virus has been reported on cereals and many other annual and perennial grasses in North America (1, 2, 11, 12), the Netherlands (13) and England (18).

During 1956 barley yellow dwarf virus was isolated from stunted, chlorotic timothy (*Phleum pratense*) collected in Wales and England, and from perennial ryegrass (*Lolium perenne*) in England. In April and May 1957, symptoms characteristic of the disease were observed on *L. perenne* at Versailles, France; on *L. perenne* and *P. pratense* near Wageningen, the Netherlands; on *L. perenne*, winter wheat and winter barley at Braunschweig, Germany; on barley clones at Schladen, Germany; on winter barley and barley rye hybrids at Hohenthurm, Germany; on *L. perenne* at Tamisto Experimental Station in Finland, and on *P. pratense* in experimental plots at Vollebekk, Norway. The presence of the virus in *L. perenne* from Finland and *P. pratense* from Norway was verified by transmission of the virus to oats with *Rhopalosiphum padi*.[3]

Barley yellow dwarf is probably the most common and widely distributed virus not only in North America but in northern Europe as well. It is potentially very destructive and can cause serious losses in cereal crops if large numbers of infective aphids migrate into susceptible varieties of spring or winter cereals in early stages of development. It probably causes significant reductions in the yields of forage grasses such as timothy and perennial ryegrass.

Ryegrass Streak Mosaic

A virus causing a light green to yellow streaking and sometimes a brown discoloration and necrosis of leaves was isolated by sap inoculations from perennial ryegrass and Italian ryegrass (*Lolium multiflorum*). It was transmitted with difficulty by an eriophyid mite commonly found on ryegrass. The isolates of the virus varied considerably in pathogenicity: some caused only mild symptoms, others severe necrosis. There also appeared to be considerable variability in the susceptibility of strains and varieties of ryegrass. The disease was most easily detected in spaced plantings where the plants could be compared easily. In solid stands of ryegrass, plants weakened by the disease were overgrown by more vigorous plants. Many diseased plants showed only mild symptoms. Some second-year stands of Italian ryegrass showed severe symptoms and were seriously affected by the disease. A similar disease was recently described in the United States (3).

Ryegrass streak mosaic was found in all areas surveyed in England, Wales and Scotland. It was also found in nearly every area examined where ryegrass was commonly grown in France, the Netherlands, Germany, Denmark and Sweden, and it was isolated from perennial ryegrass grown in experimental plots at Tamisto Experimental Station in Finland.

Since ryegrass streak mosaic is very common in northern Europe, and some strains of the grass can be severely damaged, it may be important when selecting ryegrass to be certain that new varieties or strains are not susceptible to virulent strains of the virus.

Barley Stripe Mosaic

The barley stripe mosaic disease has been known in North America since about 1910 but the cause of the disease remained unknown until 1950, when it was found to be caused by a virus (8). The virus is readily transmitted by artificial sap inoculation; it is seed-borne and can be carried in the pollen. The earliest symptoms include a whitish mottling, spotting and streaking. Necrosis of the affected leaf tissues appears as irregular brown streaks. These may be easily confused with symptoms produced by the stripe disease caused by *Helminthosporium gramineum* Rabh. Plants infected through

[3] Transmission tests were done by Mr. T. Mulligan, Rothamsted Experimental Station, Harpenden, Herts., England.

the seed may be stunted, show varying degrees of chlorotic and necrotic mottling, or may be symptomless. Grasses reported to have been infected systemically include barley, wheat, rye, sweet corn, the millets (*Setaria italica* and *Panicum miliaceum*), and several wild annuals (14). Symptoms have been produced on *Bromus inermis* and oats, and local lesions have developed on rice and " Sansum " Turkish tobacco (9). In experiments done in co-operation with Dr. B. Kassanis at Rothamsted Experimental Station in England, Italian ryegrass and spinach developed systemic symptoms, and garden beet, sugar beet and *Chenopodium amaranticolor* developed local lesions after manual inoculations with the virus.

Barley stripe mosaic was found in England on the variety " Gloire du Velay, " grown at the National Institute of Agricultural Botany at Cambridge in 1956, from seed recently obtained in France. This collection was indistinguishable, by infection and serological tests, from barley stripe mosaic obtained from " Compana " barley grown in Canada. During April 1957, the disease was observed on young plants of the variety " Engeldow India " grown in experimental plots at the Station centrale de pathologie végétale, Versailles, France. When seed obtained from the same source was grown in the greenhouse, about 15 percent of the resulting plants showed symptoms and the barley stripe mosaic virus was isolated from them. Barley stripe mosaic was also observed on several varieties of winter barley grown at the Institut für Kulturpflanzenforschung der Deutschen Akademie der Wissenschaften zu Berlin at Gatersleben, Germany. The virus was isolated from two of the varieties tested, and both isolates were serologically indistinguishable from barley stripe mosaic virus collected in England and Canada.

Since barley stripe mosaic virus is seed-borne, it can be easily distributed in infected seed to any part of the world. It is not ordinarily considered a very serious disease but severe losses in yield have been demonstrated in both barley and wheat as a result of infection by this virus (4,5). Because the virus can be transmitted by mechanical means, and since it is pollen-borne as well as seed-borne, it could become a serious nuisance in plant-breeding nurseries and experimental plots. There should be an awareness of the dangers of distributing the disease with the seed of new varieties.

European Cereal Striate Mosaic

A disease that causes fine chlorotic streaks on wheat in England was transmitted experimentally in 1956 with the fulgorid *Delphacodes pellucida* F. No other means of transmission was found. About three weeks after infective insects have fed on wheat plants, the first symptoms appear as discontinuous chlorotic striae along the veins of the leaves. In young plants, most of the leaf area becomes yellow and necrotic in a few weeks and the plants are stunted and usually die without heading. In older plants the infection causes less severe symptoms. Other grasses that can be infected include oats, barley, rye, perennial ryegrass and Italian ryegrass.

The new disease is similar in many respects to wheat striate mosaic in the United States transmitted by the leafhopper *Endria inimica* Say (15), oat mosaic in Siberia transmitted by *Delphacodes* (Delfax) *striatella* (Fallen) (17), and winter wheat mosaic in the U.S.S.R. transmitted by *Deltocephalus striatus* L. (19). The new disease will be referred to as European cereal striate mosaic.

In England, European cereal striate mosaic infected as many as 5 percent of the plants in some wheat fields in Hertfordshire, Bedfordshire, Cambridgeshire and Norfolk in 1956. The vector, *Delphacodes pellucida*, although common on grass, was never found in abundance. During May 1957 striate mosaic was observed in Germany on a few plants in a wheat field near Lage. In Denmark it was found in two winter wheat crops in Lolland and in a rye field west of Helsingor. The vector *D. pellucida* was also found in Denmark.

Although no economically serious crop losses have been attributed to European cereal striate mosaic, the disease has been found destructive to cereal plants and it could cause serious losses under conditions that would favor its spread into young crops. Professor K. Björling and Dr. D. Lihnell described a disease that causes severe damage to spring oats in northern Sweden

and Dr. E. A. Jamalainen gave a similar description of a disease in Finland which is associated with infestations of *Delphacodes pellucida* (6). It is possible that in both countries the striate mosaic virus is involved with *D. pellucida* in causing the disease of oats.

A similar destructive disease of oats and wheat associated with the same species of insect has been reported in Czechoslovakia (7).

Disease Symptoms Possibly Caused by Viruses

At Wageningen, the Netherlands, Dr. F. Wit pointed out abnormal symptoms on perennial ryegrass. The leaves of affected plants were shorter, thicker and more brittle than normal and often blisterlike thickenings were present. The leaves appeared shiny, their green color was darker than normal, and sometimes yellow streaks were evident. The condition has been observed for several years on ryegrass in the Netherlands but the cause is not known.

Mr. R. S. Badami noticed chlorotic streaks on the leaves of winter rye near Wesel, Germany. The streaks were similar in appearance to mild symptoms of wheat streak mosaic, suggesting that the cause was a virus. Similar symptoms were observed on winter rye near Hoofddorp, the Netherlands, and near Gütersloh and Braunschweig, Germany. The incidence of the disease in a field near Gütersloh varied from a trace to 75 percent of the rye plants in different parts of the field. Severe stunting was associated with the more severe streak symptoms on plants in this field.

Summary and Conclusions

Two virus diseases that are common in North America were observed in Europe in 1956 and 1957. Barley stripe mosaic (barley false stripe), which is caused by a seed-borne virus, was found in experimental plots in England, France and Germany. Barley yellow dwarf, caused by a virus that has several aphid vectors and many grass hosts, was isolated from cereals and perennial grasses, collected in England, Wales, the Netherlands, Finland and Norway. Symptoms characteristic of the disease were also observed on grasses in France, Germany and Sweden.

Three other virus diseases have been identified only in Europe, but diseases similar to those occur in North America. Cocksfoot streak mosaic, which is transmitted by aphids and affects only *Dactylis glomerata*, and ryegrass streak mosaic, which is transmitted by mites and affects species of *Lolium*, were widely distributed in England, Scotland, Wales, France, the Netherlands, Germany, Denmark and southern Sweden, where the hosts were common. Ryegrass streak mosaic was also found in experimental plots in Finland. Little damage is generally attributed to either virus but some strains of ryegrass streak mosaic virus cause severe damage to some selections of Italian ryegrass. The European type of cereal striate mosaic, which is transmitted by *Delphacodes pellucida* Fab., was found in England, Germany and Denmark. It may be a very destructive disease in certain areas where the vector is abundant.

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A Status Report on Forest Insect Conditions in the United States in 1957[1]

Compiled by Division of Forest Insect Research, Forest Service, U.S. Department of Agriculture

Status in Brief

THERE was a marked increase in the severity and extent of forest insect infestations in the United States during 1957. The increased activity was most pronounced in the coniferous forests of the West but epidemic infestations also occurred in the Northeast, the Lake States and the South. To the extent possible, epidemic populations of the pest species were suppressed by federal, state, and private landowners and land managers in a concerted effort to reduce tree damage and tree killing in affected areas. Although the intensity of infestation of a few major pest species were reduced by control action and some others declined as a result of natural control factors, other species which heretofore had been quiescent erupted to outbreak proportions.

Conditions in Oregon and Washington

The extent and severity of infestations in Oregon and Washington increased in 1957 after three years of successive decline, and 13 species of destructive pests occurred in outbreaks on a total of 2,129,440 acres. Infestations of balsam woolly aphid, *Chermes piceae* (Ratz.), Engelmann spruce beetle, *Dendroctonus engelmanni* Kopk., larch bud moth, *Zeiraphera griseana* (Hubner), spruce budworm, *Choristoneura fumiferana* (Clem), and western pine beetle, *D. brevicomis* Lec., increased in severity and extent, and blackheaded budworm, *Acleris variana* (Fern.), two species of silver fir beetles, *Pseudohylesinus* spp. and spruce bud moth, *Zeiraphera*

[1] This report is a compilation of information on the status of forest insects submitted by the forest experiment stations, the federal land-managing agencies, state forestry and conservation organizations, lumber companies, timber operators, private landowners and other individuals.

ratzeburgiana Sax., reappeared in outbreak proportions in several areas.

Conditions in California

In California, destructive insects also showed a marked increase in extent and severity. Critical epidemics of western pine beetle, *Dendroctonus brevicomis*, and mountain pine beetle, *D. monticolae* Hopk., occurred statewide, particularly in proximity to areas which had been burned in 1955. The Jeffrey pine beetle, *D. jeffreyi* Hopk., occurred in outbreak numbers in several places and the lodgepole needleminer, *Recurvaria milleri* Busck., persisted at epidemic levels in the lodgepole pine stands at Yosemite National Park. The California flat-headed borer, *Melanophila californica* Van Dyke, continued to cause severe tree killing in the southern part of the state and the trend of infestations by Douglas fir beetle, *D. pseudotsugae* (Hopk.), was upward in northwestern California. The red turpentine beetle, *D. valens* Lec., was unusually abundant in association with other bark beetles which had attacked and killed ponderosa and sugar pines, and several species of cone and seed insects were particularly destructive to the coniferous cone crop. Several other species of miscellaneous insects caused serious damage to the forest resources in many areas.

Conditions in the Rocky Mountains

The coniferous forests in the northern and southern Rocky Mountains were severely affected by several species of destructive bark beetles and tree defoliators. Bark beetles, such as mountain pine beetle, *Dendroctonus monticolae*, Black Hills beetle, *D. ponderosae* Hopk., and Engelmann spruce beetle, *D. engelmanni*, caused severe tree killing in some stands and fir engraver beetles, including *Scolytus* and *Dryocoetes* spp., as well as *D. pseudotsugae*, occurred in outbreak status in several of the fir forests in the region. The spruce budworm, *Choristoneura fumiferana*, was abundant over extensive areas in Montana and in parts of Idaho, and several other defoliators, including such species as *Epinotia meritana* Hein., *Acleria variana* (Fern.), *Semiothisa sexmaculata* (Pack), *Anoplonyx occidens* Roh. and others, were epidemic in many places. Of particular importance was the occurrence of an extensive infestation of spruce spider mite, *Oligonychus ununguis* (Jac.), on some 800,000 acres of fir forests in Montana and southern Idaho. This forest pest occurred in epidemic status principally within the areas which had been sprayed with a formulated DDT insecticide for control of the spruce budworm in 1956.

Conditions in the Lake States, Central States and the Northeast

An increase in scope and severity of several important insects occurred in the Central States, the Lake States and the Northeast. The spruce budworm, *Choristoneura fumiferana*, developed to epidemic proportions on some 300,000 acres in Maine and approximately 666,000 acres of susceptible forest type were heavily defoliated in Minnesota. Populations of Jack pine budworm, *C. pinus* Free., declined in most of the Lake States region, and there was little evidence of severe defoliation by the forest tent caterpillar, *Malacosoma disstria* Hbn. The European pine shoot moth, *Rhyacionia buoliana* (Schiff.), increased in severity in the Lake States and Central States territory, and the white pine weevil, *Pissodes strobi* (Peck), continued to cause severe damage to white pine and Jack pine in many areas throughout the regions.

Conditions in the Southern and Southeastern States

Most of the important forest insects in the Southern and Southeastern States were less destructive during 1957 than has been the case for the past several years. Large-scale control projects and low temperatures during December reduced infestations of southern pine beetle, *Dendroctonus frontalis* Zimm., and increased precipitation beneficial to tree vigor resulted in less damage caused by the *Ips* engraver beetles and the black turpentine beetle, *D. terebrans* Oliv. A few defoliating insects occurred in epidemic status in some areas but severe tree killing did not manifest itself.

Conditions in Alaska

Forest insect activity in most areas in Alaska was at a low level. The infestation of hemlock sawfly, *Neodiprion tsugae* Midd., which occurred in outbreak proportions in scattered locations in 1956, subsided completely, and the outbreak of *Ips interpunctus* Eichh. in white spruce north of Fort Yukon declined sharply. An undetermined defoliator caused moderate damage to birch stands in the vicinity of Fairbanks and localized flare-ups of the Alaska spruce beetle, *Dendroctonus borealis* Hopk., occurred in white spruce on the Kenai Peninsula. The sitka spruce beetle, *D. obesus* (Mann), was evident only at scattered points in the vicinity of Prince William Sound.

Status of Major Insect Pests

MOUNTAIN PINE BEETLE, *Dendroctonus monticolae*. The Mountain pine beetle is a serious pest of several species of pines in the western United States and outbreaks of severe proportions were reported from many areas during the year. The scope and severity of infestations was greatest in the lodgepole pine forests in the Intermountain States, in the Northern Rockies and the Pacific Northwest.

Outbreaks which resulted in the killing of large groups of lodgepole pines were particularly prevalent throughout the Intermountain States, and infestations of severe proportions were reported from the Grand Teton National Park, and on or adjacent to the Teon, Sawtooth, Ashley and Targhee National Forests in Idaho. In Utah, an extensive infestation occurred in the Wasath National Forest and systematic surveys in this area have revealed that approximately 123,000 infested trees occur on less than 100,000 acres. Outbreaks were also reported in the Ashley National Forest in Utah and in seven new infestation centers; group killings range between 50 and 7,000 trees at each location. In Montana, one outbreak of serious proportions was reported at Glacier National Park. There were 122 separate infestation centers recorded in Oregon and Washington, with heaviest concentrations of losses in the Deschutes National Forest and the Klamath Indian Reservation. Epidemic centers on a portion of the Shoshone National Forest in Wyoming continued despite concerted efforts made during the year to reduce infestations by direct means. The high level of losses also continued in the Delaney and Dingley Creek drainages at Yosemite National Park in California, due in part at least to stand weakening as a result of tree defoliation by the lodgepole needleminer, *Recurvaria milleri*.

The five-needle pines, namely sugar pine and western white pine, were also severely affected by the mountain pine beetle in several of the Western States. In California, losses in mature sugar pine increased statewide, with centers of infestations in proximity to forested areas on the Sequoia, Klamath, Stanislaus and Plumas National Forests, which were accidentally burned in disastrous fires during 1955. In Oregon, one center of infestation was reported on the Rogue River National Forest. Stands of western white pine were severely damaged on the Gifford Pinchot National Forest in Washington and infestations there covered a total of 55,840 acres. Some 24,320 acres were affected in the Willamette National Forest in Oregon and the beetle was found to be active on three separate areas on the Clearwater National Forest in Idaho.

The killing of ponderosa pine was not reported from extensive areas, although the acute infestation on 4,000 acres at Crystal Bay, Nevada, is active and poses a threat to the high-value recreational and summer-home areas at the north end of Lake Tahoe. Another infestation on some 3,360 acres where moderate to heavy tree mortality occurred, was reported on and adjacent to the Malheur National Forest in Oregon.

WESTERN PINE BEETLE, *Dendroctonus brevicomis*. The western pine beetle, long recognized as the most important natural enemy of ponderosa pine in the western United States, has been endemic in all stands for the past several years. During 1957, however, it was noticed that populations were on the increase and serious tree killing occurred at several places in the Pacific Coast States. In California, tree killing was severe on portions of the Sierra, Sequoia, Plumas, Stanislaus, Tahoe, Mendocino and Klamath National Forests, as well as at Sequoia-Kings Canyon and Yosemite Na-

tional Park. Two particularly serious epidemics occurred in the vicinity of areas which had been burned during 1955. These outbreak areas, encompassing some 173,000 acres, suffered losses of several thousands of trees and required emergency programming for control. Severity of infestations also increased in Oregon and Washington and damage occurred to pine stands on an estimated 41,760 acres. Heaviest tree killing was found on the Fremont National Forest and the Warm Springs Indian Reservation in Oregon, and on the Okanogan National Forest in Washington. These latter infestations were not precipitated by populations arising from damaged timber in burned areas. Low endemic populations and relatively little tree killing was the rule throughout the remainder of the range of this insect in the Intermountain and northern Rocky Mountain States.

DOUGLAS FIR BEETLE, *Dendroctonus pseudotsugae*. With minor exceptions, infestations of Douglas fir beetle have declined to low endemic levels in all of the extensive fir forests of the Western States. In Oregon and Washington, outbreak conditions currently were reported on a gross area of 18,400 acres, down from a peak of over 5,000,000 acres infested in 1954. One small outbreak on the Colville Indian Reservation in Washington covered 7,000 acres and two smaller infestations were reported from western Oregon. In California, the rate of loss was reported at a very low level, except for local areas in the Klamath and Six Rivers National Forests, in relation to previous epidemics.

In the Northern and Southern Rockies, and elsewhere in the Intermountain States, outbreak conditions were reported from only a few areas. In southern Utah, where the fir type occurs in patches, all of the stands were heavily infested. Other outbreaks were noted in the Yellowstone River Canyon in Yellowstone National Park, and in a few places in the Boise and Sawtooth National Forests in Idaho. In the Southwest, where stands have been subjected to deficiencies in annual precipitation for the past several years, the rate of decline in infestations was less noticeable. It is estimated, for example, that some 96 million board feet of timber were killed by the bark beetles on some 820,000 acres in parts of Arizona and New Mexico, with concentrations of tree killing most pronounced in portions of the Gila and Santa Fe National Forests, and in the Jicarilla Apache Indian Reservation. A similar situation was reported in the San Juan, Grand Mesa-Uncompahgre, Rio Grande, and San Isabel National Forests in southern Colorado.

ENGELMANN SPRUCE BEETLE, *Dendroctonus engelmanni*. This tree-killing bark beetle, which was epidemic over extensive forested areas in the northern and southern Rocky Mountains only a few years ago, has declined to endemic levels in most areas. Infestations in Colorado, New Mexico, Idaho and Montana are active in only a few local areas, and none of them are of sufficient size to require more than limited action in suppressive measures for their control. An outbreak first discovered in 1955 in the Bridger National Forest in Utah, however, is still agressive. The infestation covers a gross area of 24,000 acres and it is estimated that as many as 37,000 trees and stumps are infested. Suppressive measures in this latter area have been initiated for control and mop-up operations are being continued in the infested areas in Montana, Idaho and Colorado.

JEFFREY PINE BEETLE, *Dendroctonus jeffreyi*. This insect pest is not known to attack any host other than Jeffrey pine, hence its occurrence is restricted to the limited range of this tree species in California. The periodicity of outbreaks of the insect is unpredictable, and in spite of relatively light populations during the past several years, epidemics were recorded on some 105,000 acres in 1957. Centers of infestations occurred in the Plumas, Sierra and Inyo National Forests in central California and to a lesser degree in the southern portion of the state.

BLACK HILLS BEETLE, *Dentroctonus ponderosae*. The Black Hills beetle, one of the most important insect pests affecting ponderosa pine in the Rocky Mountains and the Black Hills, was reported in epidemic status at several locations. The outbreak in the Dixie National Forest and at Bryce Canyon National Park in southern Utah is now in its eighth year and, despite logging and direct chemical treatment of infested trees, epidemic centers of infestations continue to develop in adjacent stands. Infestations are reported to have also increas-

ed in the Carson National Forest in northern New Mexico, in the Pike, Roosevelt and San Isabel National Forests in southern Colorado, and to some degree in the Black Hills of South Dakota. Artificial measures for control are planned in all of these outbreak areas.

SOUTHWESTERN PINE BEETLE, *Dendroctonus barberi* Hopk. This insect, usually found in association with other bark beetle species in the ponderosa pine stands of the Southwest, was quite prevalent over large areas in parts of New Mexico, Arizona and southern Nevada during 1957. A complex of species, including *D. barberi*, *D. approximatus* Dietz, *Ips lecontei* Sw. and *Ips ponderosae* Sw., were associated in recently killed pines on some 1,711,000 acres in Arizona and New Mexico. The initial attack on trees usually was by *I. lecontei*, followed by *D. barberi* in the basal portion of the stem. *D. approximatus* and *I. ponderosae* occurred occasionally in conjunction with the other species. An infestation of *D. barberi* without the associated species continued in epidemic status at Charleston Mountain in Nevada, and in this area concerted efforts are being made to reduce the high rate of tree killing by spraying infested trees with toxic oils. *D. convexifrons* Hopk. occurred in outbreak status over a limited area in Mt. Graham, southwest of Safford, Arizona. It was not abundant, however, in any other area.

SITKA SPRUCE BEETLE, *Dendroctonus obesus*. The Sitka spruce beetle has been prevalent in white spruce stands at several locations in Alaska for the past several years but currently the insect is reported to be confined to relatively small areas on Prince William Sound. The largest of the infestations now known is at Blackstone Bay near Whittier but this situation is not viewed with alarm, as populations appear to be on a downward trend.

ALASKA SPRUCE BEETLE, *Dendroctonus borealis*. The rate of tree killing in stands of white spruce caused by this insect pest changed little from conditions which have existed in Alaska during the past several years. Scattered group losses were reported again in the Kenai Peninsula and south of the Alaska Range but the rate of tree killing is not excessive.

SILVER FIR BEETLES, *Pseudohylesinus* spp. The *Pseudohylesinus* beetles, which were quite destructive to stands of Pacific silver fir in Oregon and Washington during 1947-54, declined in numbers abruptly in 1955 and practically disappeared during 1956. However, these destructive pests were reported again in 1957 at five separate infestation centers in the Mt. Baker and Snoqualmie National Forests in Washington, indicating a possible resurgence of damaging populations.

WESTERN BALSAM BARK BEETLE, *Dryocoetes confusus* Sw. The status of this insect changed very little during the year and epidemic infestations were reported only in the Carson and Santa Fe National Forests in northern New Mexico and within the Roaring River drainage on the Boise National Forest in Idaho. In southern Utah and elsewhere in the Intermountain States, intensity and scope of infestations appear to have decreased.

BLACK TURPENTINE BEETLE, *Dendroctonus terebrans*. The severity of losses caused by the black turpentine beetle in pine stands of the Southern and Southeastern States was somewhat less in 1957 than during previous years. Infestations which have required suppressive measures for control in Georgia and Florida were reported to be endemic and only scattered tree killing occurred elsewhere in the two states. Two small outbreak areas were noted in North Carolina but chemical treatment of infested trees controlled them. In the Southern States, many of the pine tracts on flooded sites in some cutting areas and in stands damaged by wildfires, were attacked but prompt control in all areas reduced populations to low endemic levels.

SOUTHERN PINE BEETLE, *Dendroctonus frontalis*. The rate of tree killing caused by the southern pine beetle in all of the Southern and Southeastern States was somewhat less than has been the case for the past several years. In the Southeast, beetle activity appeared to be centered in an 8,000 square mile area in western North Carolina, eastern Tennessee, northeastern Georgia and northwestern South Carolina. Light infestations, however, were reported along the South Carolina coast and in central and eastern Virginia. For the first time in possibly 40 years, the insect was discov-

ered in portions of Louisiana and new infestations of minor proportions occurred in east Texas, the first recurrence in that area since the last major outbreak terminated in 1951. Elsewhere in the South, tree killing was at or below levels of previous years. It is interesting to note that low temperatures during the winter months killed a large percentage of the beetle broods throughout the Appalachian Mountains and this, combined with concerted efforts to suppress populations by direct means during the course of the year, may result in a termination of the long-standing epidemic in this area. Prompt action, of course, was taken to suppress the new infestations in Louisiana and east Texas, and maintenance control is being continued where the beetle is active in Mississippi and Alabama.

FIR ENGRAVER, *Scolytus ventralis* Lec. The true fir stands in several of the Western States were severely affected in 1957 by this scolytid beetle. The long-standing outbreak in stands of white fir on the Sandia Mountains east of Albuquerque, New Mexico, continued at or above the level occurring in previous years, and it is estimated that some 7,900 trees were killed during the year. Considerable tree killing also occurred in southern Utah, on and near Bryce Canyon National Park, in stands of white fir, weakened as a result of defoliation by *Epinotia meritana* Hein. Infestations covering 21,800 acres occurred in the alpine fir type in the Cascade Range in Oregon and on smaller areas in red and white fir stands in the Stanislaus and Sequoia National Forests in California.

PINE ENGRAVER BEETLES, *Ips* spp. The extent and severity of tree killing caused by the several species of pine engraver beetles in the various sections of the country is unpredictable from year to year due to wide fluctuations in populations resulting from changes in climatic conditions affecting broods and vigor of host trees. Damage to pine stands in California was reported at a low level except for localized outbreaks of *I. confusus* Lec. and *I. oregoni* (Eichh.) at low elevations in the northern Sierras and in parts of southern California. The latter species was also reported in outbreak status on some 28,000 acres in the Blue Mountains of Oregon, and in portions of the Rogue River and Mt. Hood National Forests but these infestations are more limited than those reported last year.

In the Southwest, two *Ips* species, *I. lecontei* Sw. and *I. ponderosae*, were found in association with one or more *Dendroctonus* beetles in recently killed ponderosa pine on about 1 3/4 million acres. In most instances, *I. lecontei*, was found to have initiated attack in the top portion of the trees and this discovery indicates the species to be of primary, rather than secondary importance in the losses sustained in the pine stands of Arizona and New Mexico. The insect was also found attacking and killing pinyon pines over extensive areas in Arizona, New Mexico, southern Utah and western Nevada, another indication that the insect is a primary forest pest.

The widespread infestations of *I. interpunctus*, which caused heavy losses in stands of white spruce in Alaska in recent years, was reported to have subsided during 1957 and it is expected that only lightly scattered infestations will be found during 1958.

In the Southeast, outbreaks of *I. calligraphus* Germ., *I. grandicollis* Eichh. and *I. avulsus* Eichh., were extensive and very destructive in the east-central portions of Virginia and North Carolina, and in northeastern South Carolina during the summer months but adverse factors of one type or another caused the infestations to collapse suddenly in late August and early September. The severe 1956 outbreaks of these latter species in east Texas, Oklahoma and Arkansas also declined abruptly in 1957. Heavy rains in these areas during the spring months presumably increased the vigor of the host trees and made them less vulnerable to attack. Whatever the reason, by midyear *Ips* populations in the Southern States appeared to be confined to trees struck by lightning, or those severely weakened by other causes. In southern Ohio and central Missouri, *Ips* beetles were reported in several red pine plantations of from 5 to 100 acres in size.

PINE REPRODUCTION WEEVILS, *Hylobius*, *Pachylobius*, *Pissodes* and *Cylindrocoptorus* spp. Several species of weevils, which are destructive to young pines on plantations and in natural stands, were abundant during the year. The white pine weevil, *Pis-*

sodes strobi (Peck), was prevalent again in white pine in most of the New England and Northeastern States and high percentages of planted pines were attacked in many areas. The insect was also abundant on jack, red, Scotch and Austrian pine in the Lake States. In the latter areas, as much as 40 percent of the trees in some plantations were attacked and infestations on red pines were reported as severe in several areas in Michigan and Wisconsin. The pales weevil, *Hylobius pales* (Hbst.), and the pitch-eating weevil, *Pachylobius picivorus* Germ., which have been pests of areas newly planted to pines in the Southern States, were less of a problem. Damage by these insects can be avoided if six to nine months are allowed to lapse between the time of harvest cuttings and new plantings. *Cylindrocoptorus eatoni* Buch. continued to cause serious damage to ponderosa and Jeffrey pines on plantations in California and a new center of infestation in that state was detected in an outplanting of hybrid pines in the El Dorado National Forest. An outbreak covering some 400 acres of plantations in the Shasta-Trinity National Forest was controlled during the year by aerial application of DDT.

PINE ROOT-COLLAR WEEVIL, *Hylobius radicis* Buch. Heavy damage to plantations and natural stands of red pine caused by pine root-collar weevil was reported in various parts of the Lake States region. Damage was severe to red and Scotch pines planted as windbreaks and shelterbelts in parts of Minnesota and Michigan and in the sandy soil types in northwestern and central Wisconsin.

CALIFORNIA FLAT-HEADED BORER, *Melanophila californica* Van Dyke. This buprestid beetle, a major pest of ponderosa and Jeffrey pine in California, occurred in epidemic proportions at Mt. Laguna in the Cleveland National Forest. On some 7,500 acres in this area, it is estimated that about 2.5 percent of the green stand, or approximately 13,000 trees, were killed.

CONE AND SEED INSECTS. Insects which attack and destroy the cones and seeds of coniferous trees were reported as serious pests in many sections of the country. In California, where the seed crop was relatively light during 1957, several species caused serious damage. The sugar pine cone beetle, *Conophthorus lambertianae* Hopk., destroyed an estimated 90 percent of the sugar pine cones, pine seed worms reduced the seed crop of Jeffrey pine seed cones by about 75 percent, and the cones and seeds of ponderosa pine and Douglas fir were practically wiped out by one or more pest species. Cone moths, *Dioryctria* spp. and *Barbara* spp., were also abundant and, in conjunction with *Megastigmus* spp., were destructive statewide. Heavy infestations of *Conophthorus* beetles were reported affecting cones of red pine in Cass County, Minnesota, and slash pine cones in Florida were found to be heavily attacked by *Dioryctria* moths.

SPRUCE MITE, *Oligonychus ununguis*. A new situation which developed during 1957 was the occurrence of severe infestations of spruce mites in the fir forests of Montana and southern Idaho, which had been sprayed with DDT in 1956 for control of spruce budworm, *Choristoneura fumiferana*. Although a few lesser infestations were noted outside sprayed areas, heavy mite populations and tree damage coincided closely with the sprayed areas. The damage in southern Idaho occurred on some 23,300 acres and approximately 790,000 acres were severely affected in Montana. It is of interest that these mite infestations are the first to have occurred in epidemic proportions in the coniferous forests anywhere in the nation subsequent to aerial application of DDT sprays for control of tree defoliators.

BALSAM WOOLLY APHID, *Chermes piceae*. The severity and extent of infestations by this destructive insect continued to increase in the fir stands of the Pacific Northwest. First noted in epidemic proportions on Pacific silver fir and subalpine fir in 1954, infestations increased rapidly from some 295,000 acres in 1955 to 559,000 acres in 1957. The largest increase occurred in the Willamette National Forest in Oregon, where its spread during the year was estimated at 233,000 acres. Heavy tree killing of severely attacked trees was conspicuous in all epidemic centers and salvage logging has been stepped up to the extent practicable and feasible in an effort to utilize the dead and dying material prior to its deterioration. Research on the aphid was given high priority in 1957 and an important start was made to investigate the possibilities of biological

control by importing a predaceous fly, *Aphidoletes thomsoni* Mohn, from Europe.

A new infestation, believed to be of recent origin, was discovered on Frazier fir on Mt. Mitchell in North Carolina but its severity and extent is not yet known. Infested trees, however, appear covered with a white, woolly substance, indicating heavy populations unaffected by natural enemies. The status of the woolly aphid in the Northeastern States has changed but slightly as compared to previous years.

SPRUCE BUDWORM, *Choristoneura fumiferana.* This destructive insect, distributed throughout the range of susceptible host type in the United States, occurred in epidemic status on several million acres in many parts of the country. In Maine, infestations were found on a total of 2,289,000 acres, of which 270,000 acres sustained heavy defoliation and 707,000 acres medium defoliation. While the intensity of the infestation on these 979,000 acres constituted a considerable increase over previous years, the over-all extent of the outbreak decreased, due to a lower level of populations in the lightly infested areas of 1956. Because of an expected high population and severe tree damage in Aroostock County, and the unlikely prospects that natural factors will exert a controlling influence on the population, aerial application of DDT insecticide on some 300,000 acres is planned for 1958. Infestations in Minnesota also increased and approximately 660,000 acres of balsam fir were moderately to heavily defoliated. The stands of spruce and fir in much of this area now have suffered from two or more years of heavy larval feeding and it is expected that serious defoliation will occur again in 1958. Budworm populations remained at relatively low levels in Michigan but heavy defoliation was reported in northwestern Wisconsin for the first time in many years.

The spruce budworm has been epidemic in portions of north Idaho and in Montana for the past ten years and despite aerial spraying for control on more than 2,000,000 acres since 1953, it is estimated that infestations still occur on some 2,846,000 acres. Damage being caused to the fir stands throughout the areas of infestation has been severe and many of the younger understory trees have been killed. There is little evidence to date of any major change in population densities and it can be expected that the infestation will continue in epidemic proportions during 1958.

In southern Idaho, 512,300 acres were defoliated in parts of Boise, Challis, Payette, Sawtooth, and Salmon National Forests. In New Mexico, the 154,950 acres which are affected represent a decline from conditions which existed in that state the previous year. In Arizona, increased populations at high elevations in the Kaibab National Forest and at Grand Canyon National Park have resulted in severe defoliation and plans have been made to spray some 90,000 acres in that area for control during 1958.

The epidemic that began in Oregon and Washington in 1944 is still in progress and after two years of an apparent decline in intensity, is once again on the increase. Currently, some 830,960 acres are infested in or adjacent to the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forest in the Blue Mountain region of Oregon and plans have been made to spray this area for control during 1958.

JACK PINE BUDWORM, *Choristoneura pinus.* This important insect pest, which has occurred in epidemic numbers over relatively large areas in the Lake States region during the past several years, declined in all areas in 1957. Infestations in Minnesota disappeared completely in most areas and those in Wisconsin were much reduced from levels of the past few years. A few areas of light defoliation were reported from the Upper Peninsula of Michigan and some stands in the Lower Peninsula were infested to a moderate degree. Adverse weather and a high degree of parasitism are credited as factors causing the decline of the budworm populations.

BLACKHEADED BUDWORM, *Acleris variana.* For the first time in more than a decade, this destructive insect pest occurred in epidemic proportions in Washington. Infestations were found to occur on some 252,800 acres in and adjacent to the Snoqualmie National Forest and Yakima Indian Reservation, where western hemlock, Pacific silver fir, Douglas fir and grand fir were attacked. Previous epidemics have occurred principally on the Olympia Peninsula and, after lasting about two years, have subsided rather

suddenly without causing significant tree killing. In Montana, high endemic populations were reported throughout many Douglas fir stands east of the Continental Divide, in conjunction with infestations of the spruce budworm. Epidemic infestations on a total of 32,000 acres, however, occurred in hemlock stands at scattered locations in the Kootenai National Forest and Glacier National Park in western Montana and in a portion of the Kaniksu National Forest in northern Idaho. In some of the areas there was a noticeable reduction in larval population prior to pupation, and it is believed that the trend of infestations is downward.

DOUGLAS FIR TUSSOCK MOTH, *Hemerocampa pseudotsugata* McD. At periodic intervals, this important insect pest has occurred in epidemic proportions in the fir forests of most of the Western States. During 1957, a localized outbreak was reported on some 10,000 acres of Douglas fir second growth in Owyhee County, Idaho, and the same species, or a closely related one, became epidemic on approximately 160 acres of white fir in the vicinity of Pinal Mountain near Globe, Arizona. The moth population in Idaho was found to be affected by a virus organism late in the year and the outbreak is expected to collapse without benefit of artificial measures for its control. Aerial spraying of DDT will be undertaken, however, to control the outbreak in Arizona. No new egg masses or other evidence of infestations were to be found in the fir forests of California where the insect had been controlled by aerial spraying in 1956, and no active infestations were reported from Montana.

SPRUCE BUD MOTH, *Zeiraphera ratzeburgiana* Sax. This insect pest, an accidental introduction in the Pacific Northwest, occurred in epidemic status on Sitka spruce on 52,000 acres along the Oregon and Washington coasts during the year. Areas of heaviest damage were reported to occur on about 34,000 acres in the Siuslaw National Forest.

LARCH BUD MOTH, *Zeiraphera griseana*. This insect pest, first noted in epidemic status on 33,000 acres in the northern Rocky Mountains in 1955, now occurs on an estimated 250,000 acres in scattered centers in Montana and north Idaho. The outbreak is characterized by a concentration of populations in mature stands of western larch that occur in patches along the summits of ridges and in headwaters of many drainages. Little or no defoliation was noticeable below elevations of 4,200 feet but above that level larval feeding was heavy and extended to elevations above 6,000 feet. Outbreaks were also reported from some 39,520 acres in and adjacent to the Okanogan National Forest in Washington. No control is contemplated in any of the infestation areas.

LARCH LOOPER, *Semiothisa sexmaculata*. This defoliating insect was reported from widespread areas in the northern Rocky Mountains and although populations usually were relatively light, heavy infestations were encountered along the Blackfoot River northeast of Bonner, Montana, and at a few other locations along the Canadian border. There are no known records of the occurrence of this insect in these areas prior to 1955.

ALPINE FIR DEFOLIATOR. An unidentified leaf-feeding insect was reported to have defoliated approximately 153,000 acres of alpine fir in and adjacent to the Boise National Forest in Idaho. This is the second year that defoliation has occurred in this general vicinity and the infestation appears to manifest itself only in areas which had been sprayed for control of spruce budworm. Collections of insects have been made from the affected area but identifications are not yet available.

BIRCH DEFOLIATOR. A Lepidopterous insect, as yet unidentified, was reported in epidemic status on paper birch over a wide area in interior Alaska, and observations in the infestation area have indicated that moderate to heavy defoliation can be expected throughout the paper birch stands during 1958.

ASPEN LEAFROLLER. An unidentified defoliator, believed to be *Choristoneura* sp., was reported in outbreak status on some 500 acres of quaking aspen in the Carson National Forest in New Mexico.

SPRUCE MEALYBUG, *Puto* sp. Approximately 60,000 acres of Engelmann spruce at two locations in the Dixie and Fishlake National Forests in southern Utah are heavily infested by this unnamed mealybug. Trees of all ages are affected and, in areas where the pest has been active for several

years, the vigor of the trees has been materially reduced and many of them are severely deformed. The extent of tree killing in the area has not been determined but probably occurs only after continued feeding over a period of years. Methods for control of this pest species are not known.

LARCH CASEBEARER, *Coleophora laricella* (Hbn.). This European insect, which is widely distributed in the eastern United States, was found in 1957 for the first time near St. Maries, in northern Idaho. Inasmuch as the infestation occurred on a gross area of some 15,000 acres, this pest insect presumably has been present in stands of western larch for the past several years. Defoliation within the area of infestation was severe and it is to be expected that heavy damage to the host trees will continue during 1958.

PINE BUTTERFLY, *Neophasia menapia* F. & F. At periodic intervals this pest occurs in outbreak proportions in the pine stands of the Western States and because of its destructiveness, special attention is given to detection of incipient infestations. While several localized infestations were discovered in the Boise, Payette and Salmon National Forests in Idaho, none were of serious consequence.

FIR NEEDLEMINER, *Epinotia meritana* Hein. The long-standing outbreak of this needleminer on some 10,000 acres of white fir stands at Bryce Canyon National Park and in the Dixie National Forest in southern Utah, is now reported to be endemic. Although the decrease in intensity of the outbreak is attributed primarily to parasites, an aerial spraying program over 4,000 acres also helped to reduce the pest population. During the past ten years, this infestation has caused some killing of trees, principally in the understory, and there has been severe weakening of the stand as a whole. Currently, the weakened stand is highly susceptible to attack by bark beetles and tree killing by *Scolytus ventralis* is reported to be on the increase in the affected area.

LODGEPOLE NEEDLEMINER, *Recurvaria milleri.* This important forest pest continued in epidemic status at Toulumne Meadows, Yosemite National Park, California, and cumulative defoliation during the past several years is now causing mortality of affected trees. Since 1957 was a flight year for the moth, it is highly likely that new areas of susceptible type were invaded. Efforts thus far to suppress this insect by direct means have not been successful and it is feared that the entire forest stand in affected areas will soon be killed. A closely related species, tentatively identified as *Recurvaria* species, increased in severity and extent in the ponderosa pine stands of the Southwestern States. Currently, some 126,000 acres are infested, whereas only 50,000 acres were reported in 1956. The new areas of infestation are in the vicinity of El Rito, New Mexico, Williams, Arizona, and Rye, Colorado. Damage in all areas affected previous years' growth and defoliation thus far has not been severe enough to cause tree mortality.

PINE SAWFLIES, *Diprion* and *Neodiprion* spp. Infestations of pine sawflies, ranging from a few acres to more than a million acres in size, were reported from many sections of the country throughout the year. The largest infestation reported was *N. pratti pratti* Dyar, which extended from an area north of Baltimore to the lower end of the Potomac River in Maryland, a gross area of some 1,500,000 acres. Affected trees were pitch pine and Virginia pine. The occurrence of other sawfly species on much smaller acreages were as follows: *N. lecontei* (Fitch) was prevalent in pine plantations in many areas, infestations were severe in parts of Michigan, Wisconsin, Minnesota and in the Southern and Southeastern States, particularly in east Texas and west Florida; it was also unusually abundant in New York, western Maryland and northeastern Ohio. *N. pratti paradoxicus* Roh. was extensive in southern New Jersey, and pitch and shortleaf pines were defoliated over a wide area. *N. sertifer* (Geoff.) caused severe damage to young hard pines in the Lower Peninsula of Michigan and the species appears to be increasing in severity and extent in southern Connecticut and southeastern New York. Populations in Ohio were variable, lower in some areas and higher in others. A virus organism sprayed into infestations during 1953 and 1955 appears to have materially reduced populations in those areas. *D. similis* (Htg.) was abundant on white pine in parts of Minnesota and Wisconsin and for the

first time it was reported from local areas in southern Michigan. *N. excitans* Roh. occurred in outbreak status in Arkansas, Texas, Louisiana, Mississippi and in five counties in north-central Florida. *N. taedae linearis* Ross was abundant in Arkansas, at scattered locations in South Carolina, and in the northeastern quarter of Missouri and in southern Illinois. Infestations in Missouri were observed at scattered locations over a gross area of 122,000 acres, with the heaviest infestation center on shortleaf pine in a portion of the Poplar Bluff Ranger District, Shawnee National Forest. *N. nanulus nanulus* Schedl and. *N. manrus* Rch. caused moderate defoliation of jack pine in the vicinity of Bemidji, and in Crow Wing County, Minnesota, and *N. nanulus* was quite noticeable on some 2,000 acres in St. Lawrence County, New York. *N. pinetum* (Nort.) was also reported to be abundant on white pine in New York and in central Ohio. An unidentified species occurred on about 600 acres of ponderosa pine in the vicinity of Grants, New Mexico, but larval feeding was confined to previous years' growth and to date there has been no mortality of affected trees.

SPRUCE AND FIR SAWFLIES, *Neodiprion* and *Diprion* spp. The known status of a few species of sawflies attacking spruce and fir is as follows: *N. abietis* complex was endemic in stands of Douglas fir throughout southern Idaho but epidemic at the craters of the Moon National Monument in that state and in Hubbard County, Minnesota. The recent outbreak of *N. tsugae* Midd. in southeast Alaska collapsed from natural causes and close search of the spruce stands from the air and on the ground failed to reveal new outbreak areas. One small infestation of *D. hercyniae* (Htg.) was reported on white spruce in northeastern Wisconsin.

LARCH SAWFLY, *Pristiphora erichsonii* (Mtg.). Heavy defoliation of larch by this sawfly was reported throughout the range of the tree species in the Lake States region. The area of defoliation in Minnesota was about the same as that recorded in 1956, and tree mortality resulting from nine consecutive years of defoliation is becoming quite evident in the north-central part of that state. In Wisconsin, defoliation ranging from heavy to complete, occurred over most of the northern half of the state and many stands in the east-central area were infested to varying degree. Infestations and severe defoliation also occurred over much of the Upper and Lower Peninsulas of Michigan. This species, first found in the northern Rockies during 1934, spread throughout western Montana and northern Idaho by 1944. There have been no records, however, of its occurrence in these areas since that time.

The two-lined larch sawfly, *Anoplonyx occidens*, and the western larch sawfly, *A. laricivorus* Rch. & Nidd., however, were reported to have occurred in association with *Semiothisa sexmaculata* in defoliation of western larch throughout the range of this tree species in Idaho and Montana. Although these two species of sawfly are known to have occurred in epidemic numbers in this general area during 1921 and again in 1938, in each instance the outbreaks subsided the following year and neither insect was recorded again until 1955.

EUROPEAN PINE SHOOT MOTH, *Rhyacionia buoliana*. The severity of European pine shoot moth infestations increased materially in the extensive areas planted to red pine and Scoth pine in the Lake States and Central States region. In Michigan, virtually all of the pine plantations are heavily infested in the Lower Peninsula and the insect is also well established in several counties in the Upper Peninsula. In Wisconsin, there has been a spread of infestations north along Lake Michigan and also to the west in the southern part of the state. The insect also caused serious damage to red pine in southern Connecticut and New York, northern New Jersey, Pennsylvania, Delaware and northern West Virginia.

Two species of other pine tip moths occurred in abundance in the Southern, Southeastern, Northeastern and Central States region in 1957. *R. frustrana* (Comst.) continued at a high level throughout most of the Southeast and it was prevalent also in the South and in portions of Ohio. In northern Mississippi, Louisiana and Texas, trees of commercial size were heavily infested and, from the air, the red-fringed crown of affected trees resembled group killing by bark beetles. The closely related species, *R. rigidana* (Fern.), was not as common in any area but it was more abundant than in former years.

ZIMMERMAN PINE MOTH, *Dioryctria zimmermani* (Grote). This pine moth was reported in abundance near La Porte, Indiana, on approximately 800 acres of planted pines. Red, Scotch and pitch pines were affected but Scotch pine was damaged to a greater degree than the other species.

MIMOSA WEBWORM, *Homadaula albizziae* Clarke. This insect pest was reported to have caused heavy defoliation of honey locust and mimosa trees at several locations in the vicinity of Indianapolis, Indiana, and in southeastern Missouri and Ohio. Defoliated trees, however, were not killed and the infestations are not expected to continue in outbreak proportions.

SCALE INSECTS. The status of damaging species of scale insects throughout the forested areas of the country is not accurately known but several species causing damage in local areas were reported during the year. Small localized infestations of *Nuculaspis californicus* (Colm.) and *Phenacaspis pinifoliae* (Fitch) occurred on ponderosa pines in the vicinity of Spokane, Washington, as remnants of epidemic populations that were decimated during 1951 and again in 1955 by extremely low winter temperatures. The latter species was also reported throughout Minnesota on several pine hosts. The Prescott scale, *Matsucoccus vexillorum* Morrison, was found in moderate numbers on ponderosa pine at the North Rim, Grand Canyon National Park and in the Prescott National Forest in Arizona, but tree damage was restricted to branch killing in affected areas. Moderate infestations of pine tortoise scale, *Toumeyella numismaticum* (P & McD.), occurred on Scotch pine in parts of Minnesota, Michigan and Wisconsin, and on Virginia pine in several areas in Maryland, West Virginia and Pennsylvania. In these latter states, surveys during the summer months revealed that predation by the Coccinellids, *Hyperaspis binotata* (Say) and *H. signata* (Oliv.), and the Lepidopteron, *Lactilia coccidivora*, had controlled the scale in areas where serious infestations were reported. The red pine scale, *Matsucoccus resinosae* B. & G., is still abundant in some plantations of red pine in the Bridgeport, Connecticut, area and on Long Island, and in Westchester County, New York.

TENT CATERPILLARS, *Malacosoma* spp. The severity and extent of tent caterpillar infestations changed very little in most sections of the country from conditions noted during 1956. While *M. disstria* was found in outbreak proportions in northwestern Wisconsin and in the western part of the Upper Peninsula in Michigan, tree defoliation in Minnesota was confined to a comparatively small area in south-central St. Louis County. *M. fragilis* Stretch was abundant and caused heavy defoliation to stands of aspen in parts of Arizona, New Mexico and Colorado but the acreages of infestation were reduced over 1956 and the trend of populations is downward.

GYPSY MOTH, *Porthetria dispar* (L.). The gypsy moth infestations remained at a low level in New York and most of New England. In Maine and portions of Vermont and New York, low winter temperatures and late spring frosts were apparently responsible for considerable reduction in gypsy moth populations. The large-scale federal spray program aimed at eradication of this pest in the tri-state area of New York, New Jersey and Pennsylvania covered a gross area of 2,902,517 acres, and other co-operative eradication spraying included 102,820 acres in Pennsylvania and 18,880 acres in Michigan. In the latter state, no moths could be found subsequent to spraying and it is possible that the insect has now been eradicated in that area.

COOLEY GALL LOUSE, *Chermes cooleyi* Gill. High endemic infestations of this insect were reported in stands of Douglas fir of Christmas tree size in the upper Kootenai River and Tobacco River Valleys in northwestern Montana. The infestations in all instances appeared to be associated with severe infections of a needle blight identified as *Rhabdocline pseudotsugae* Syd.

SARATOGA SPITTLEBUG, *Aphrophora saratogensis* (Fitch.). This insect continued to be a major pest in red pine plantations in parts of Wisconsin and the Upper Peninsula of Michigan, and on jack pine in Minnesota. There was, however, a widespread reduction in nymphal populations in some infested areas during the spring months and artificial measures for control were needed only on approximately 10,000 acres during the year.

TEXAS LEAF-CUTTING ANT, *Atta texana* Buckley. This insect is an important pest

in parts of Texas and Louisiana, and plantations of pine seedlings up to four years of age are often entirely destroyed within a period of a few days when other green plants are not available during the winter months. Ant towns and resultant defoliation of pines have become more numerous in recent years in sandy soil where annual rainfall has been deficient. In areas where ant infestations are prevalent, fumigation of the soil is a prerequisite to planting.

VARIABLE OAK LEAF CATERPILLAR, *Heterocampa manteo* (Dbldy.). The variable oak leaf caterpillar was reported from only one small area in Warwick County, Virginia, during the year in contrast to the outbreak covering several millions of acres in the state in 1956. For reasons not wholly known, there was little or no emergence of adult insects despite the fact that prepupae were abundant in the soil during the winter of 1956–57. Sudden collapse of infestations is a characteristic of this pest.

ELM SPANWORM, *Ennomos subsignarius* (Hbn.). The elm spanworm, which has been epidemic in the hardwood stands of northern Georgia for the past two years, increased in severity and extent during 1957. The acreage of defoliation, currently estimated on some 100,000 acres in Georgia, also occurs on about 200,000 acres in southeastern Tennessee and in southwestern North Carolina. Heaviest defoliation thus far has occurred on hickory and oak growing along the tops of ridges.

SHORT-TAILED CRICKET, *Anurogryllus muticus* (DeG.). This insect was discovered as a new pest of germinated pine seedlings in parts of Louisiana, east Texas and Arkansas. It was found to sever the stem of the seedling and to consume the tender foliage in its underground tunnel.

FALL CANKERWORM, *Alsophila pometaria* (Harr.). A noticeable increase in extent and severity of cankerworm infestations occurred in parts of Maryland and Maine during the spring months. While chestnut oak and associated oak species in the infestation areas were stripped of foliage, little or no feeding was noticed on other tree species in the affected range.

SADDLED PROMINENT, *Heterocampa guttivitta* (Wlk.). The large-scale outbreak of this insect, which occurred in parts of New York, Pennsylvania, New Hampshire and New York during 1956, was reported to have collapsed from natural causes. Heavy parasitism to larval brood is believed to have caused the reduction in populations.

PINE LEAF APHID, *Pineus pinifoliae* (Fitch). The coniferous galls on red spruce caused by this aphid were particularly abundant in most of the Northeastern States, especially in western Maine, and in New York and Vermont. Another gall former on spruce and a tip feeder on white pine, *Pineus floccus* (Patch), caused exceptionally severe damage to red spruce in Vermont and was also reported frequently from New York.

FRUIT TREE LEAF ROLLER, *Archips argyrospila* (Wlkr.). For the second year the fruit tree leaf roller was epidemic over a large area on the Lower Peninsula of Michigan and infestations of lighter proportions were reported from northeastern Wisconsin. Heavy parasitism of larval broods occurred in both states, however, and infestations are expected to decline in 1958. Another leaf roller, *Sparganothis pettitana* Robinson, and a webworm, *Tetralopha* sp., caused severe defoliation of sugar maple in parts of Wisconsin and Michigan. Feeding by the two insect species was somewhat lighter than in 1955 and 1956, and with the abundance of predators and parasites noted in 1957, it is expected that the infestations will be materially reduced during 1958.

RED-HUMPED OAKWORM, *Symmerista albicosta* (Hbn.). The red-humped oakworm was reported to have occurred in outbreak status on some 45,000 acres of oak type in several counties in Michigan and trees were severely defoliated in all areas affected. Due to parasitism of larval broods, the outbreak is expected to subside before serious damage or tree mortality occurs.

WHITE GRUBS, *Phyllophaga* spp. Unusually heavy flights of *Phyllophaga* beetles were reported from Texas and other Southern States during the early spring months, and subsequently severe damage by grubs occurred to pine seedlings in many areas. In one instance a million nursery seedlings were reported to have been killed in Arkansas.

Plant Quarantine Announcements

Fiji

The Disease of Plants (Prohibited Imports) Proclamation of 18 January 1957, published in the *Fiji Royal Gazette Supplement* No. 3 on 25 January 1957, revokes Proclamation No. 4 of 1933 under the same title as amended by Proclamations No. 9 of 1933 and No. 1 of 1936.

The new Proclamation provides that the importation of all plants is prohibited unless a written permit for the importation has been first obtained from the director of agriculture, who may determine the conditions which will be specified in the permit. The following plants, however, may be imported without a permit:

a) Seeds of garden vegetables and flowers from the United Kingdom, Australia, Canada, New Zealand and the U.S.A., in sealed packets or in bulk bearing the label of a commercial seedsman.

b) Grains, pulses and spices imported for human or animal consumption, except unhusked rice.

c) Fresh vegetables and fruit for human consumption from New Zealand, except cabbages, cauliflowers, Brussels sprouts and kohlrabi, and any other members of Cruciferae.

d) Potatoes and onions for human consumption from Australia, New Zealand, Canada and the U.S.A.

Guernsey (Channel Islands)

The Potatoes Importation Order 1958, which became applicable on 27 March 1958, provides that potatoes from any country in the continent of Europe other than France, may be landed in or transshipped through Guernsey, if each consignment is accompanied by two certificates signed by an authorized official of the phytopathological service of the country in which the potatoes were grown. The certificates should be in the forms set out in the two schedules to the Order, one being similar to the form annexed to the International Plant Protection Convention and the other stating that in the country of origin there has been no outbreak of Colorado beetle during the preceding 12 months, within 25 kilometers from the place where the potato plants were grown.

By the 1958 Order, the Potatoes Importation Order 1955 is repealed.

News and Notes

International Desert Locust Information Service

The work of co-ordinating current information on locusts in Africa and southwestern Asia commenced in 1929 in a special section of the Imperial Institute of Entomology, London (later the Anti-Locust Research Centre), and in 1931 the First International Anti-Locust Conference in Rome recommended that the Institute should be adopted as the international information center. As regards the desert locust, this work has led to the issue of monthly summaries and forecasts since 1943.

The panel of experts on Long-term Policy of Desert Locust Control, convened by FAO in London in 1956, recommended that all information on the desert locust and relevant weather phenomena should be collected in a single co-ordinating center which would prepare and distribute summaries and forecasts to all interested countries and organizations.

The FAO Technical Advisory Committee on Desert Locust Control, at its sixth session held in Teheran in 1956, considered that the Anti-Locust Research Centre would be the most suitable co-ordinator of such information. This recommendation was further supported by the seventh session of the same Committee at Tangiers in 1957, at which it was suggested that FAO should discuss with the Government of the United Kingdom the arrangements necessary to establish an international co-ordinating center.

The discussions took place and were successfully concluded on 24 March 1958. They resulted in the creation of the International Desert Locust Information Service (I.D.L.I.S.), which forms an integral part of the Anti-Locust Research Centre but is sponsored by and receives financial support from FAO. This Information Service will, in the future, prepare monthly desert locust situation summaries and forecasts and distribute them to all governments and organizations concerned. It will also issue, whenever necessary, special warnings of dangerous developments and distribute them directly and through FAO, radio and the press.

The Information Service can be effective only if it is regularly supplied with timely and detailed information. All governments and organizations concerned are requested to ensure that regular reports, on standard forms, are submitted monthly, to reach the Anti-Locust Research Centre (1, Princes Gate, Kensington, London, S.W. 7, England) not later than the 15th of the month following that covered by the reports. Standard report forms, in English and French, can be obtained from FAO headquarters in Rome and from FAO regional and country offices. Governments and organizations are also requested to cable to the Centre (ANTILOCUST LONDON) information on outstanding developments, such as the first arrival of swarms and the onset of breeding.

The summaries will be accompanied by maps illustrating, by means of symbols denoting swarms, hopper bands, nonswarming locust populations, etc., the locust infestation reported during the period concerned.

In order that the I.D.L.I.S. summaries and maps may be distributed as rapidly as possible, they will be sent in the original English versions from the Anti-Locust Research Centre direct to all addresses, by air mail, about the 20th of each month. Subsequently, French translations of the summaries only will be distributed by FAO, Rome, as soon as possible, to the governments requiring them.

The present I.D.L.I.S. summaries deal only with the current desert locust situation. The possibilities of extending them to include the consideration of the corresponding current weather will be examined during an initial two-year period.

Roma, 1958 — Tipografia del Senato del Dott. G. Bardi

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